

What is claimed is:

1. A fuel cell system comprising:

5 a fuel cell for generating electric energy based on electrochemical reaction of hydrogen and oxygen;

a hydrogen supply apparatus for feeding hydrogen into said fuel cell;

a hydrogen supply path for introducing the hydrogen from said hydrogen supply apparatus into said fuel cell;

10 an off-gas circulation path for introducing an off-gas into said hydrogen supply path, said off-gas containing non-reacted hydrogen exhausted from said fuel cell without being consumed in said chemical reaction among the hydrogen fed into said fuel cell;

15 off-gas circulating means for circulating said off-gas into said off-gas circulation path and also for mixing said off-gas with a main stream of hydrogen fed from said hydrogen supply apparatus;

main stream hydrogen amount detecting means for detecting a hydrogen amount in said main stream of hydrogen;

off-gas circulation amount detecting means for detecting a circulation amount of said off-gas; and

20 impurity removing means for removing impurities not contributing to the electrochemical reaction from said off-gas circulation path,

wherein an operation of said impurity removing means is controlled based on a hydrogen concentration in said off-gas circulation path, and

25 the hydrogen concentration in said off-gas circulation path is calculated based on the hydrogen amount in said main stream of hydrogen and the circulation amount of said off-gas.

2. The fuel cell system in accordance with claim 1, wherein

said off-gas circulating means is an ejector pump, and

30 said main stream hydrogen amount detecting means calculates the

hydrogen amount in said main stream of hydrogen based on a pressure of said hydrogen supply path at an upstream side of said ejector pump and a pressure at a discharge side of said ejector pump, as well as based on an opening area of a nozzle of said ejector pump.

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3. The fuel cell system in accordance with claim 1, wherein

said off-gas circulating means is an ejector pump with a nozzle which is disposed in said hydrogen supply path to suck and discharge said off-gas by utilizing entrainment function caused by said main stream of hydrogen ejected from said nozzle, and

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said off-gas circulation amount detecting means calculates the circulation amount of said off-gas based on a pressure difference between a suction side and a discharge side of said ejector pump and also based on the hydrogen amount in said main stream of hydrogen.

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4. The fuel cell system in accordance with claim 1, wherein a hydrogen amount fed into said fuel cell is calculated based on the hydrogen concentration in said off-gas circulation path.

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5. The fuel cell system in accordance with claim 1, wherein the operation of said impurity removing means is controlled in such a manner that the hydrogen amount fed into said fuel cell satisfies a predetermined condition.

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6. The fuel cell system in accordance with claim 5, wherein said predetermined condition is a requested stoichiometric value which is a stoichiometric value obtained from a requested power generation amount, when the stoichiometric value is defined as a value equivalent to the hydrogen amount fed into said fuel cell divided by a hydrogen consumption amount obtained from a power generation amount of said fuel cell.

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7. The fuel cell system in accordance with claim 5, wherein said predetermined condition is a requested hydrogen concentration obtained from a requested power generation amount.

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8. The fuel cell system in accordance with claim 1, wherein said off-gas circulating means has a function of variably controlling the circulation amount of said off-gas.

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9. The fuel cell system in accordance with claim 8, wherein the circulation amount of said off-gas is controlled based on a hydrogen concentration in said off-gas circulation path in such a manner that the hydrogen amount fed into said fuel cell satisfies a predetermined condition.

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10. The fuel cell system in accordance with claim 9, wherein said predetermined condition is a requested stoichiometric value which is a stoichiometric value obtained from a requested power generation amount, when the stoichiometric value is defined as a value equivalent to the hydrogen amount fed into said fuel cell divided by a hydrogen consumption amount obtained from a power generation amount of said fuel cell.

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11. The fuel cell system in accordance with claim 9, wherein said predetermined condition is a requested hydrogen concentration obtained from a requested power generation amount.

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